CHAPTER 4-7c

INVERTEBRATES: ROTIFER TAXA – MONOGONONTA

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INVERTEBRATES: ROTIFER TAXA – MONOGONONTA

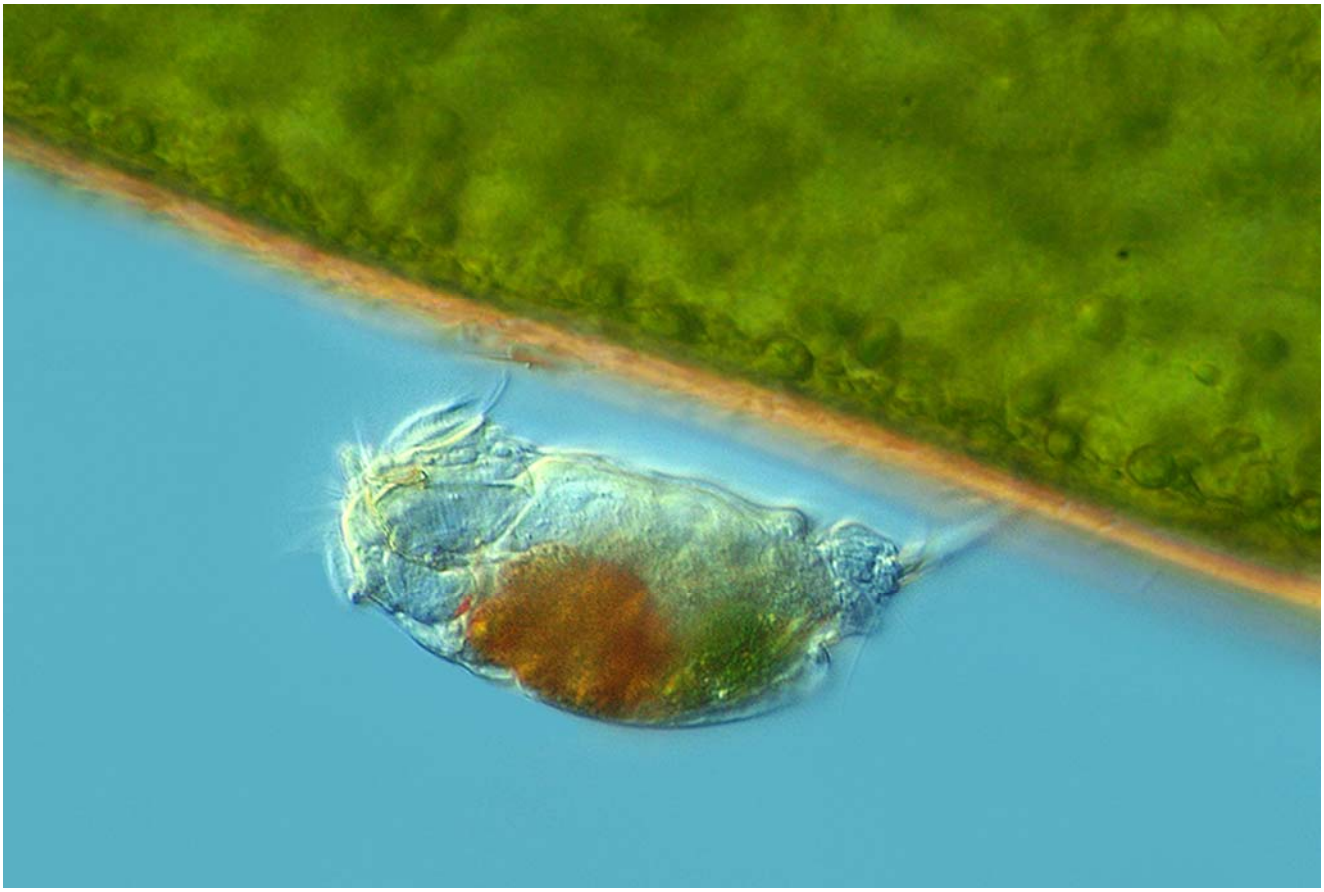

Figure 1. ***Cephalodella***, a common genus among ***Sphagnum***. Photo by Proyecto Agua Water Project Creative Commons.

Notommatidae

The name **Notommatidae** literally means "eyes on the back." The members of this family have a nearly cylindrical body with a thin foot and two toes. Many of its species are known from bryophytes.

Cephalodella

Cephalodella (Figure 1) is a large genus, with many species that occur among bryophytes. Most of these are associated with ***Sphagnum*** (Figure 2). These include ***Cephalodella abstrusa*** (Myers 1942), ***C. anebodica*** from bogs (Figure 2) (Błedzki & Ellison 2003), ***C. apocolea*** (Figure 3-Figure 5; Hingley 1993; Jersabek *et al*. 2003), ***C. auriculata*** (Figure 6-Figure 9; Hingley 1993; Jersabek *et al*. 2003), ***C. belone*** (Figure 10; Jersabek *et al*. 2003), ***C. biungulata*** (Figure 11; Jersabek *et al.* 2003), ***C. catellina*** (Figure 12-Figure 13; Horkan 1981; Hingley 1993), ***C. compressa*** (Figure 28; Jersabek *et al.* 2003), ***C. derbyi*** (Figure 29; Plewka 2016), ***C. elegans*** (Figure 30; Jersabek *et al*. 2003), ***C. forficula*** (Figure 26-Figure 25; Horkan 1981; Hingley 1993), ***C. gibba*** (Figure 15-Figure 17; Horkan 1981; Hingley 1993; De Smet 2001; Jersabek *et al.* 2003; Bielańska-Grajner, *et al*. 2011), ***C. gibboides*** (Bielańska-Grajner *et al*. 2011), ***C. gigantea*** (Figure 31; Plewka 2016), ***C. intuta*** (Figure 21-Figure 22; Hingley 1993), ***C. licinia*** (Figure 32; Jersabek *et al*. 2003), ***C. lipara*** (Figure 33-Figure 34; Jersabek *et al.* 2003), ***C. mira*** (Figure 35-Figure 36; Jersabek *et al.* 2003), ***C. mucronata*** (Figure 37; Jersabek *et al.* 2003), ***C. nana*** (Figure 38-Figure 39; plus other bryophytes; Hingley 1993), ***C. nelitis*** (Figure 40; Jersabek *et al.* 2003), ***C. pheloma*** (Hingley 1993), ***C. plicata*** (Myers 1942), ***C. rotunda*** (Figure 18; Plewka 2016), and ***C. tantilloides*** (Hingley 1993; Bielańska-Grajner *et al*. 2011).

Figure 2. ***Sphagnum*** "bog" (probably a poor fen) with pools. Photo by Boŕeal, through Creative Commons.

Figure 3. ***Cephalodella apocolea***, a ***Sphagnum*** dweller, showing curved toes. Photo by Michael Plewka <www.plingfactory.de>, with permission.

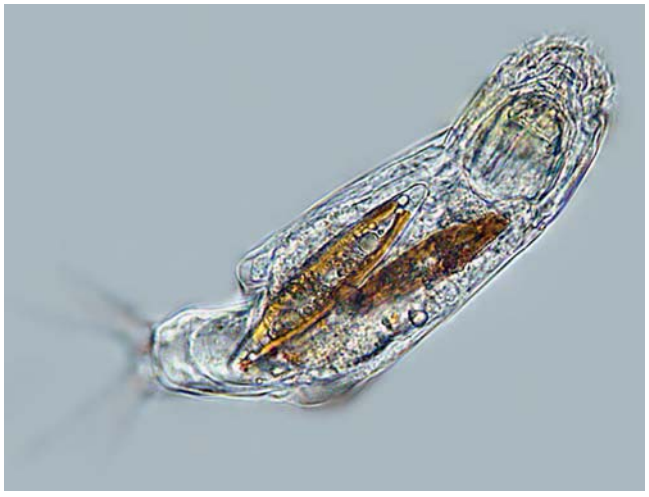

Figure 4. ***Cephalodella apocolea*** with diatoms in its gut. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 5. ***Cephalodella apocolea***, a species known from ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Cephalodella auriculata (Figure 6-Figure 9) is a bryophyte dweller in northern climates. In Alaska it occurs among the submerged mosses in the trenches between the polygons (Segers *et al*. 1996).

Figure 6. ***Cephalodella auriculata***, a species known from bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 7. ***Cephalodella auriculata***, a species known from bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 8. ***Cephalodella auriculata***, a ***Sphagnum*** dweller. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 9. ***Cephalodella auriculata***, a ***Sphagnum*** dweller. Photo by Yuuji Tsukii, with permission.

Figure 10. ***Cephalodella belone*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

On Svalbard ***C. biungulata*** (Figure 11) lives exclusively on submerged mosses (De Smet 1993).

Figure 11. ***Cephalodella biungulata***, a species known from ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Cephalodella catellina (Figure 12-Figure 13), ***C. evabroedae***, ***C. gibba*** (Figure 15-Figure 17), ***C. rotunda*** (Figure 18), and ***C. ventripes*** var. ***angustior*** (Figure 19) occur on submerged mosses, but also in the plankton on Svalbard (De Smet 1988, 1990, 1993). ***Cephalodella catellina*** comprised up to 20% of the rotifers on the submerged mosses (De Smet 1988). On the other hand, ***C. biungulata*** (Figure 11), ***C. glandulosa***, ***C. hoodii*** (Figure 20), ***C. intuta*** (Figure 21-Figure 22), and ***C. megalocephala*** (Figure 23) occurred exclusively on mosses (De Smet 1993). ***Cephalodella gibba*** and ***C. sterea*** (Figure 24) are among the most abundant of the submerged, moss-dwelling rotifers on Hopen, Svalbard (De Smet 1990). In Alaska, ***C. gibba*** occurred on submerged mosses in the trenches between polygons (Segers *et al*. 1993). Other species on submerged mosses on Hopen included ***Cephalodella forficula*** (Figure 26-Figure 25) and ***C. misgurnus***.

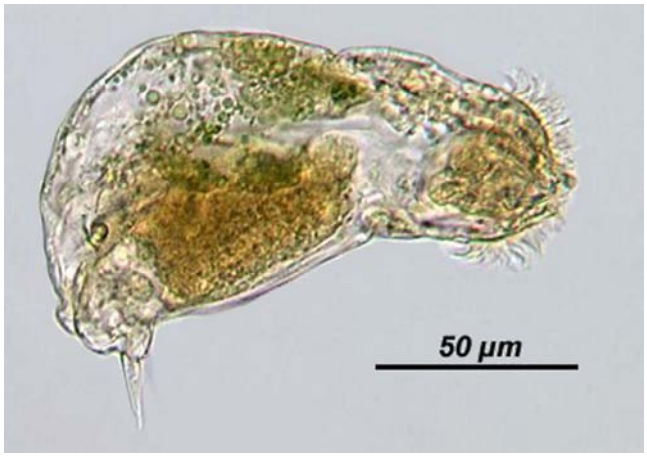

Figure 12. ***Cephalodella catellina*** from a ***Sphagnum*** bog. Photo by Jersabek *et al*. 2003, with permission.

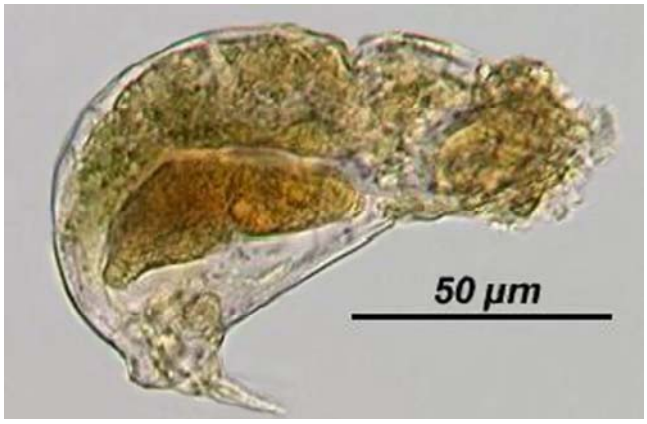

Figure 13. ***Cephalodella catellina*** from a ***Sphagnum*** bog. Photo by Jersabek *et al*. 2003, with permission.

Cephalodella gibba (Figure 15-Figure 17) is a cosmopolitan planktonic species of small bodies of water (de Manuel Barrabin 2000). It lives in littoral areas of both fresh and brackish water and occasionally lives in branchial chambers of crustaceans. It feeds on single-celled algae, flagellates, and ciliates. It prefers cold water (Segers 2001), but is known from a range of 6.4-18.8°C (de Manuel Barrabin 2000). Its known *p*H range is 6.6-8.48. In Germany, it is known from habitats with *p*H <3.0 (Deneke 2000). It typically occurs in the sediments (Hingley 1993; Schmid-Araya 1995), but it also is found among the Antarctic mosses (De Smet 2001).

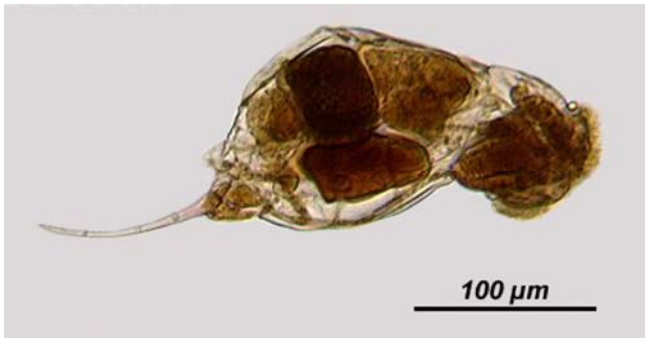

Figure 14. ***Cephalodella gibba***, a ***Sphagnum*** associate. Photo by Jersabek *et al*. 2003, through Creative Commons.

Figure 15. ***Cephalodella gibba*** lateral view, a plankton and littoral species that also associates with ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 16. ***Cephalodella gibba***, a species known from bogs and from ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 17. ***Cephalodella gibba*** in copulation, with the smaller male on left. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 18. ***Cephalodella rotunda***, a ***Sphagnum*** dweller. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 19. ***Cephalodella ventripes***, a species of plankton and submerged mosses. Photo by Michael Plewka <www.plingfactory.de>.

Figure 20. ***Cephalodella hoodii***, a species that occurs exclusively on submerged mosses on Svalbard. Photo by Michael Plewka <www.plingfactory.de>.

Figure 21. ***Cephalodella intuta***, a species known from bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 22. ***Cephalodella intuta***, a species known from bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 23. ***Cephalodella megalocephala***, a species that occurs exclusively on submerged mosses on Svalbard. Photo by Michael Plewka <www.plingfactory.de>.

Figure 24. ***Cephalodella sterea*** from a pond in Ontario, Canada. This species also occurs on **bog mosses**. Photo by Jersabek *et al*. 2003, with permission.

Cephalodella forficula (Figure 26-Figure 25) is a free-swimming, tube-dwelling species (Dodson 1984) known to live among bryophytes and in bog pools (Figure 2). It is a cosmopolitan littoral species that lives mostly in small bodies of water, occasionally as part of the plankton (de Manuel Barrabin 2000). It occurs in alkaline habitats but prefers slightly "acid" water in a *p*H range around 8.2 and a temperature near 19°C. Dodson (1984) describes its tubes made of mucus in detritus-rich environments. It closes the tubes at both ends and swims back and forth in its tube, living on bacteria shed from the inner walls. Dodson considers only small rotifers <1 mm can use this feeding strategy because of surface-to-volume considerations. In high food conditions, rotifers removed from the tube immediately build another, but under starvation or low oxygen conditions they leave the tube and swim about.

Figure 25. ***Cephalodella forficula***, a species known to live among bryophytes and in bog pools. Photo by Jersabek *et al*. 2003, with permission.

Figure 26. ***Cephalodella forficula***, a species known to live among bryophytes and in bog pools. Photo by Jersabek *et al*. 2003, with permission.

Figure 27. ***Cephalodella forficula*** swimming. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 28. ***Cephalodella compressa*** from among ***Sphagnum.*** Photo by Jersabek *et al*. 2003, with permission.

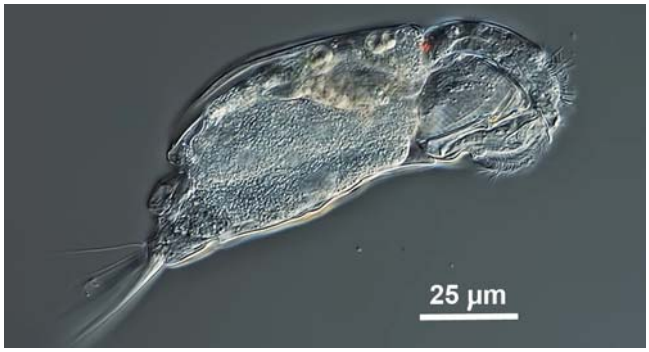

Figure 29. ***Cephalodella derbyi*** from ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

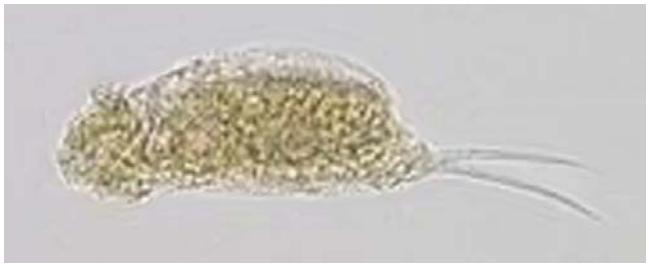

Figure 30. ***Cephalodella elegans*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

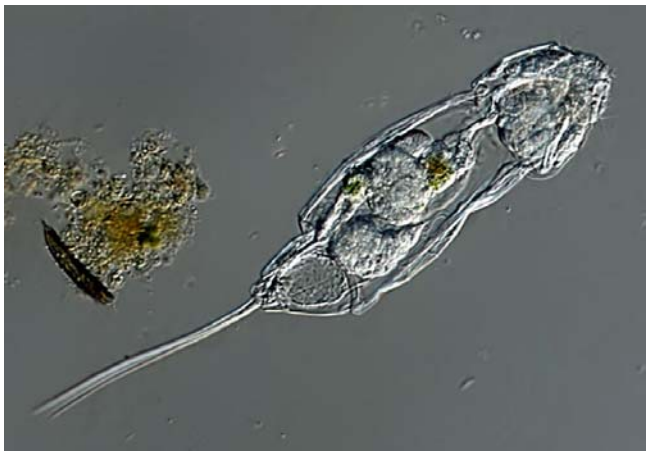

Figure 31. ***Cephalodella gigantea*** from ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 32. ***Cephalodella licinia*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 33. ***Cephalodella lipara*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

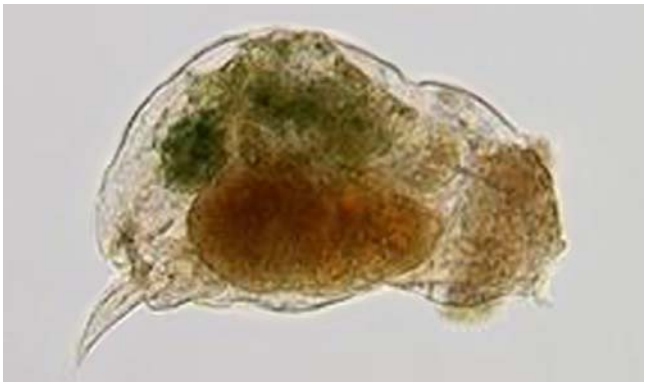

Figure 34. ***Cephalodella lipara*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 35. ***Cephalodella mira*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 36. ***Cephalodella mira*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 37. ***Cephalodella mucronata*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 38. ***Cephalodella nana***, a species known from bryophytes, including ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 39. ***Cephalodella nana***, a species known from bryophytes, including ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 40. ***Cephalodella nelitis*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

A number of ***Cephalodella*** species live in bogs, but their specific affiliation with ***Sphagnum*** (Figure 41) is not specified. These include ***Cephalodella eva*** (Figure 42-Figure 43; also with stream mosses; Horkan 1981; Jersabek *et al.* 2003), ***C. exigua*** (Figure 44) in bogs (Jersabek *et al.* 2003), ***C. hoodii*** (Figure 20; Horkan 1981), ***C. lepida*** (Figure 45; Jersabek *et al.* 2003), ***C. physalis*** (Figure 46-Figure 48; Hingley 1993; Jersabek *et al.* 2003), ***C. rostrum*** (Hingley 1993), ***C. sterea*** (Figure 24; Horkan 1981), ***C. tachyphora*** (Figure 49-Figure 50; Jersabek *et al.* 2003), and ***C. tantilla*** (Figure 51; Hingley 1993).

Figure 41. ***Sphagnum capillifolium***, member of a genus that is home for many species of rotifers. Photo by J. C. Schou, with permission.

Figure 42. ***Cephalodella eva*** from a stream in Pennsylvania, USA. This species has been collected on mosses. Photo by Jersabek *et al.* 2003, with permission.

Figure 43. ***Cephalodella eva*** from the Pocono Mountains, in Pennsylvania, USA. This species is known from ***Sphagnum*** bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 44. Side view of ***Cephalodella exigua*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

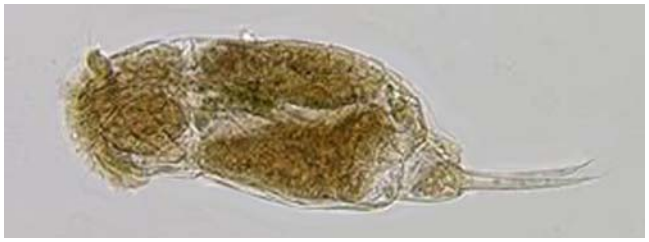

Figure 45. ***Cephalodella lepida*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

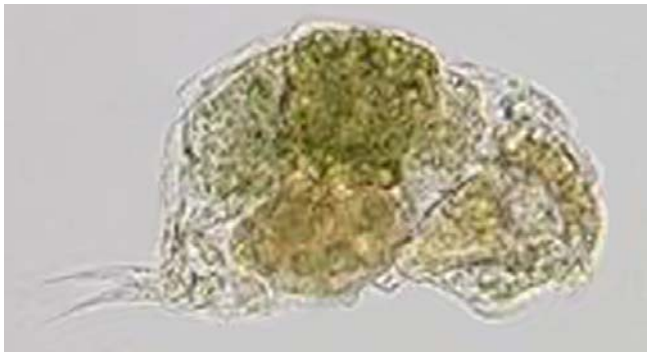

Figure 46. ***Cephalodella physalis***, a species known from ***Sphagnum*** bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 47. ***Cephalodella physalis***, a species known from ***Sphagnum*** bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 48. ***Cephalodella physalis***, a species known from ***Sphagnum*** bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 49. ***Cephalodella tachyphora*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 50. ***Cephalodella tachyphora*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 51. ***Cephalodella tantilla*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Cephalodella subsecunda (Figure 52) is known from ***Sphagnum subsecundum*** (Figure 53) (Jersabek *et al.* 2003). Some ***Cephalodella*** are known from submersed ***Sphagnum*** (Figure 41), including ***C. gracilis*** [Figure 54-Figure 55; Bielańska-Grajner *et al*. 2011; Plewka 2016; in streams Madaliński 1961), and ***C. inquilina*** (Figure 56; Jersabek *et al*. 2003). ***Cephalodella ventripes*** (Figure 19) occurs not only on ***Sphagnum*** (Hingley 1993), but as already noted, it also occurs on submerged moss and among the plankton (De Smet 1993; Plewka 2016). On Svalbard, ***Cephalodella ventripes*** var. ***angustior*** occurs mostly between submerged mosses (De Smet 1988).

Figure 52. ***Cephalodella subsecunda*** from among emergent ***Sphagnum subsecundum*** (Myers 1942). Photo by Jersabek *et al.* 2003, with permission.

Figure 53. ***Sphagnum subsecundum***, home of ***Cephalodella subsecunda*** and other rotifers. Photo by Michael Lüth, with permission.

Figure 54. ***Cephalodella gracilis***, a species from submersed ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 55. ***Cephalodella gracilis***, a species known from bryophytes. Photo by Jersabek *et al*. 2003, with permission.

Figure 56. ***Cephalodella inquilina*** from among submerged ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Other members of ***Cephalodella*** occur on submerged mosses (***Cephalodella cyclops***; Figure 57; Plewka 2016), including ***Fontinalis*** (Figure 58) (***C. dorseyi***; Figure 59; Jersabek *et al*. 2003). ***Cephalodella megalotrocha*** is also a bryophyte dweller (Horkan 1981).

Figure 57. ***Cephalodella cyclops***, a species that occurs in ponds with submerged mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 58. ***Fontinalis hypnoides*** with detritus. ***Fontinalis*** is a suitable home for ***Cephalodella dorseyi***. Photo by Janice Glime.

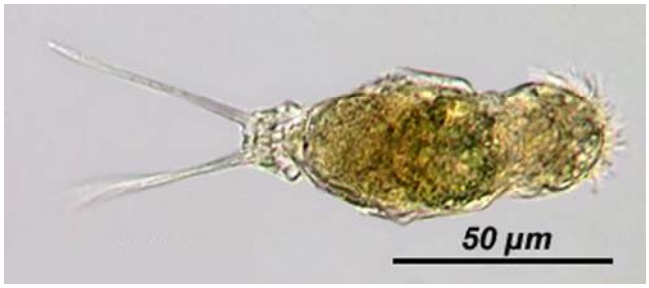

Figure 59. ***Cephalodella dorseyi*** from among ***Fontinalis***. Photo by Jersabek *et al*. 2003, with permission.

Drilophaga

Drilophaga judayi (Figure 60) is an ectoparasitic rotifer (but occasionally free-swimming). In the Poconos Mountains, Pennsylvania, USA, it was found only among

Sphagnum (Figure 41) (Myers 1942). In a genus of only three species, two live in association with ***Sphagnum***. The second of these is ***D. bucephalus*** (Figure 61), an ectoparasite on oligochaetes and a ***Sphagnum*** dweller (Plewka 2016).

Figure 60. ***Drilophaga judayi***, a parasitic rotifer that occurs only among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 61. ***Drilophaga bucephalus*** from ***Sphagnum.*** Photo by Michael Plewka (www.plingfactory.de), with permission.

Enteroplea

Enteroplea lacustris (Figure 62-Figure 63) occurs among ***Sphagnum*** (Figure 41) and in bog pools (Figure 2). Myers (1942) received a collection of a clump of wet ***Sphagnum*** from the Poconos Mountains, Pennsylvania, USA, and kept it in an aquarium for several months. Then a large number of ***E. lacustris*** appeared. There has been no report of it in the Poconos Mountains since.

Figure 62. ***Enteroplea lacustris***, a species that lives among ***Sphagnum*** and in bog pools. Photo by Jersabek *et al.* 2003, with permission.

Figure 63. ***Enteroplea lacustris*** from among ***Sphagnum*** and in bog pools. Photo by Jersabek *et al.* 2003, with permission.

Eosphora

Eosphora is a genus with only seven known species. Of these, two seem to find bryophytes suitable for habitation. ***Eosphora ehrenbergi*** (Figure 64) occurs in bog pools (Horkan 1981; Jersabek *et al.* 2003). ***Eosphora najas*** (Figure 65) is a littoral-planktonic species that eats detritus (Plewka 2016), but it is known to occur among bryophytes in streams (Madaliński 1961) and ponds (De Smet 1993).

Figure 64. ***Eosphora ehrenbergi*** male from Utah, USA, a species known from bog pools. Photo by Jersabek *et al.* 2003, with permission.

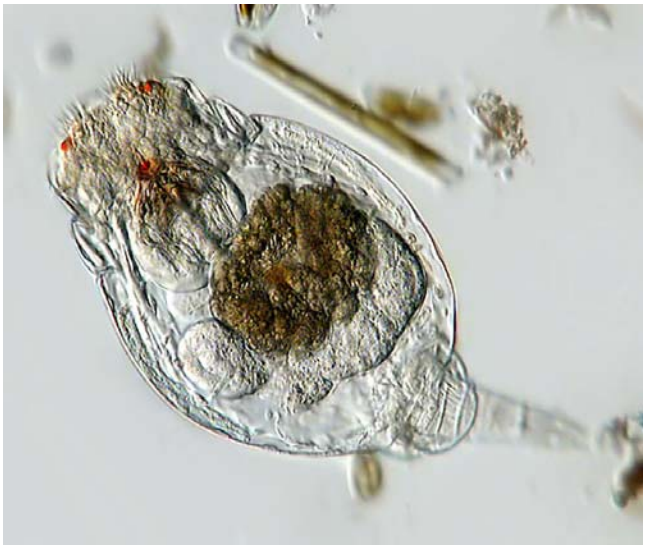

Figure 65. ***Eosphora najas***, showing eyespots, a planktonic species that eats detritus. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Eothinia

Eothinia has only six species. Only one of these, ***Eothinia elongata*** (Figure 66), associates with bryophytes by living in bogs (Horkan 1981).

Figure 66. ***Eothinia elongata*** from Three Lakes, Wisconsin, USA, a species known from bogs. Photo by Jersabek *et al.* 2003, with permission.

Monommata

The bryophyte dwellers in ***Monommata*** are all associated with ***Sphagnum*** (Figure 41). Hingley (1993) reported ***Monommata actices*** (Figure 67), ***M. aeschyna***, ***M. astia*** (Figure 68), ***M. longiseta*** (Figure 69-Figure 70), ***M. maculata*** (Figure 71), and ***M. phoxa*** as ***Sphagnum*** associates. To these, Plewka (2016) added ***M. dentata*** (Figure 72) and Jersabek *et al*. (2003) added ***M. hyalina*** (Figure 73). ***Monommata aequalis*** (Figure 74; Horkan 1981) and ***M. grandis*** (Figure 75; Plewka 2016) occur in bog pools and ***Sphagnum*** ponds (Figure 2), respectively. On Svalbard, De Smet (1993) found a species of ***Monommata*** exclusively on submerged mosses.

Figure 67. ***Monommata actices***, a species that is known from ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 68. ***Monommata astia***, a species known to inhabit bryophytes, including ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 69. ***Monommata longiseta***, a planktonic species that also inhabits bryophytes. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 70. ***Monommata longiseta***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

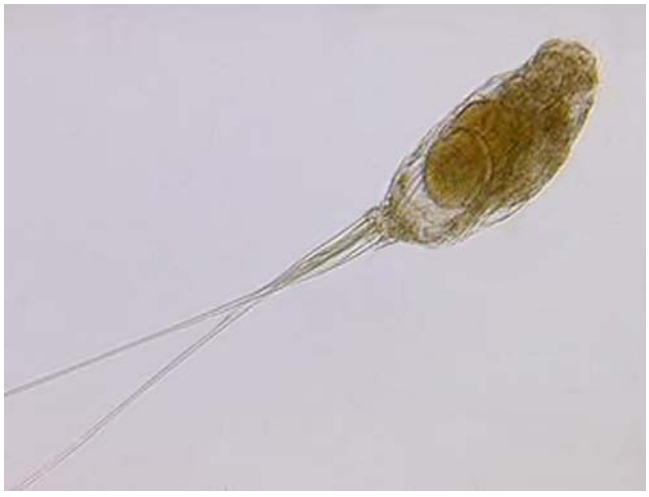

Figure 71. ***Monommata maculata***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 72. ***Monommata dentata***, a ***Sphagnum*** dweller. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 73. ***Monommata hyalina*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

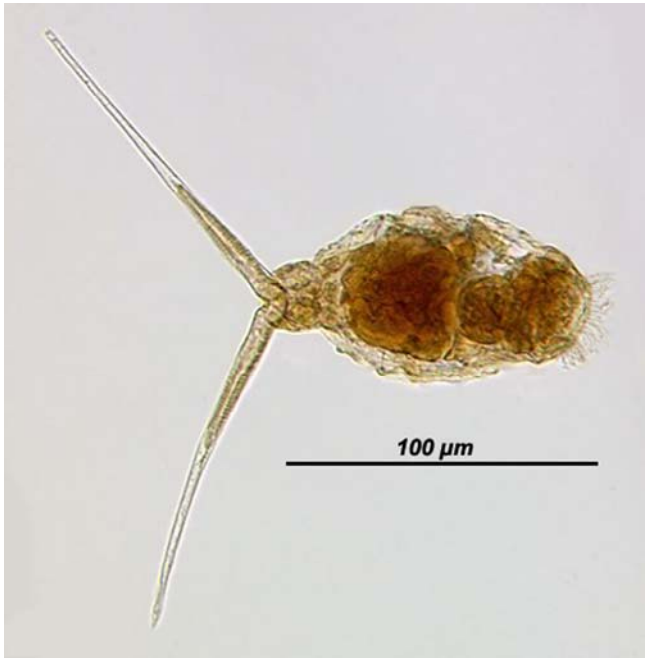

Figure 74. ***Monommata aequalis***, a bog-pool dweller. Photo by Jersabek *et al.* 2003, with permission.

Figure 75. ***Monommata grandis***, an inhabitant of ***Sphagnum*** ponds. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Notommata

This genus likewise contributes to the rotifer fauna of ***Sphagnum*** (Figure 41). Among these ***Sphagnum*** associates one can find ***Notommata allantois*** (Figure 76; Hingley 1993; Plewka 2016), ***N. cerberus*** (Figure 77-Figure 78); Horkan 1981; Hingley 1993; Jersabek *et al.* 2003; Plewka 2016), ***N. cherada*** (Figure 79; Jersabek *et al.* 2003), ***N. contorta*** (Figure 80; Hingley 1993; Jersabek *et al.* 2003), ***N. copeus*** (Figure 81-Figure 83; Horkan 1981; Hingley 1993; Plewka 2016), ***N. cyrtopus*** (Figure 87; bog pools and other bryophytes; Horkan 1981), ***N. doneta*** (Myers 1942), ***N. falcinella*** [Figure 88; on ***Sphagnum subsecundum*** (Figure 53; Harrington & Myers 1922; Hingley 1993), ***N. fasciola*** (Figure 89; Jersabek *et al.* 2003), ***N. groenlandica*** (Figure 90-Figure 91; Hingley 1993; Plewka 2016), ***N. pachyura*** (Figure 92-Figure 94; Horkan 1981; Hingley 1993), ***N. peridia*** (Figure 95; Myers 1942), ***N. pygmaea*** (Figure 96; Myers 1942), ***N. saccigera*** (Figure 97-Figure 98; Harrington & Myers 1922; Myers 1942; Hingley 1993), and ***N. tripus*** (Figure 99-Figure 100; bog pools, others; Horkan 1981; Hingley 1993). Horkan (1981) reported ***Notommata brachyota*** from bryophytes.

Figure 76. ***Notommata allantois*** with green gut, a species that occurs in ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Notommata cerberus subsp. ***parvida***; Figure 77-Figure 78) is a cosmopolitan species known to inhabit bryophytes

(de Manuel Barrabin 2000) and to live in bog pools (Horkan 1981). It is an omnivore that consumes other rotifers, desmids, diatoms, and flagellates (de Manuel Barrabin 2000). Its known *p*H is around 8.2 and temperature around 18.8°C.

Figure 77. **Notommata cerberus**, a ***Sphagnum*** dweller. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 78. ***Notommata cerberus*** subsp. ***parvida***, a cosmopolitan species known to inhabit bryophytes and to live in bog pools. Photo by Jersabek *et al.* 2003, with permission.

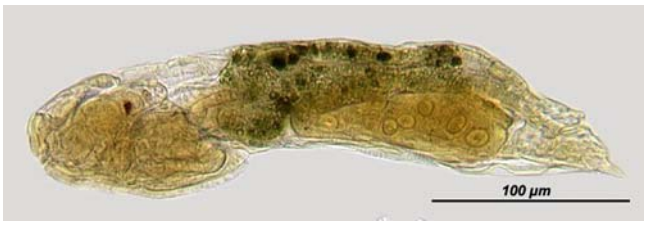

Figure 79. ***Notommata cherada***, a ***Sphagnum*** dweller. Photo by Jersabek *et al*. 2003, with permission.

Figure 80. ***Notommata contorta***, known from a ***Sphagnum*** pool. Photo by Jersabek *et al.* 2003, with permission.

Notommata copeus (Figure 81-Figure 83) is a cosmopolitan, littoral species (de Manuel Barrabin 2000) known to inhabit bryophytes. It also occasionally occurs in the plankton (de Manuel Barrabin 2000) and in bog pools (Horkan 1981). It is known from a *p*H around 7 and temperature around 6°C (de Manuel Barrabin 2000). Its food is mostly zygnematalean algae – ***Mougeotia*** (Figure 84), ***Spirogyra*** (Figure 85), and ***Zygnema*** (Figure 86), that occur in these pools.

Figure 81. ***Notommata copeus*** with mucilage & bacteria, giving it a fuzzy look. This is a species from ***Sphagnum***. Note the desmid ***Closterium*** in the upper left, a potential food item. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 82. ***Notommata copeus***, a bryophyte dweller. Photo by Jersabek *et al.* 2003, with permission.

Figure 83. ***Notommata copeus***, a species known to inhabit bryophytes and bog pools. Photo by Jersabek *et al.* 2003, with permission.

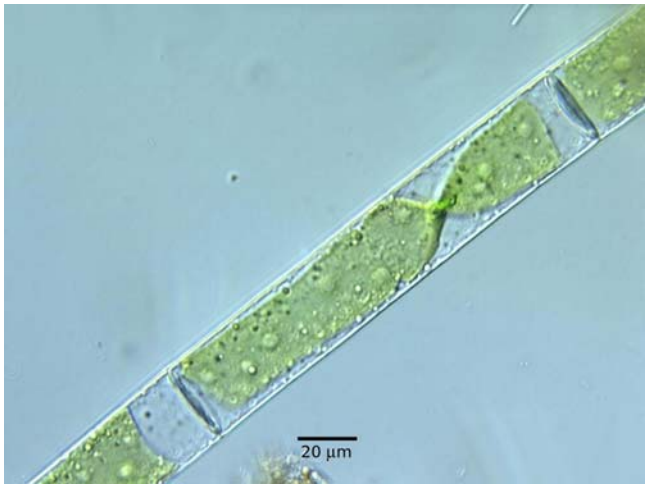

Figure 84. ***Mougeotia***, food for ***Notommata copeus***. Note the twisted chloroplast in the ***Mougeotia***. Photo by Jason Oyadomari, with permission.

Figure 85. ***Spirogyra***, food for ***Notommata copeus***. Photo from Landcare Research, Manaaki Whenua, through Creative Commons.

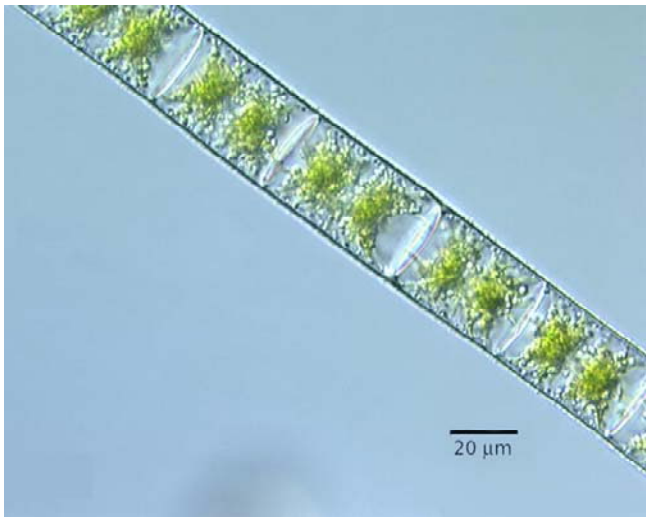

Figure 86. ***Zygnema***, food for ***Notommata copeus***. Photo by Jason Oyadomari, with permission.

Figure 87. ***Notommata cyrtopus*** from New Jersey, USA. This species has been collected from bryophytes and is known from bog pools. Photos by Jersabek *et al.* 2003, with permission.

Figure 88. ***Notommata falcinella***, a species known from bryophytes, including ***Sphagnum subsecundum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 89. ***Notommata fasciola*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 90. ***Notommata groenlandica*** with the desmid ***Netrium***, a food item from ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 91. ***Notommata groenlandica*** from a ***Sphagnum*** bog. Photo by Michael Plewka <www.plingfactory.de>, with permission.

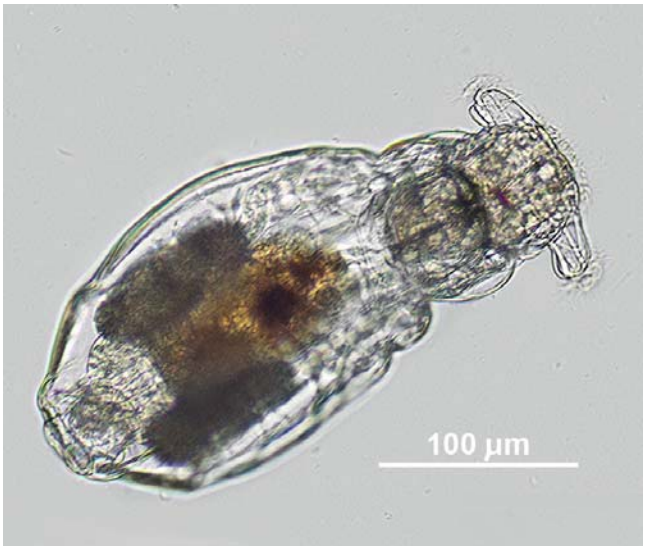

Figure 92. ***Notommata pachyura*** from detritus that it can find among ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 93. ***Notommata pachyura***, a species known to inhabit bryophytes and to occur in bogs. It feeds on non-colonial desmids (GLERL 2009). Photo by Jersabek *et al.* 2003, with permission.

Figure 94. ***Notommata pachyura***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 95. ***Notommata peridia***, a ***Sphagnum*** dweller. Photo by Jersabek *et al.* 2003, with permission.

Figure 96. ***Notommata pygmaea***, a ***Sphagnum*** dweller. Photo by Jersabek *et al*. 2003, with permission.

Figure 97. ***Notommata saccigera***, a species known to inhabit bryophytes, including ***Sphagnum*** (Myers 1942). Photo by Jersabek *et al.* 2003, with permission.

Figure 98. ***Notommata saccigera***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

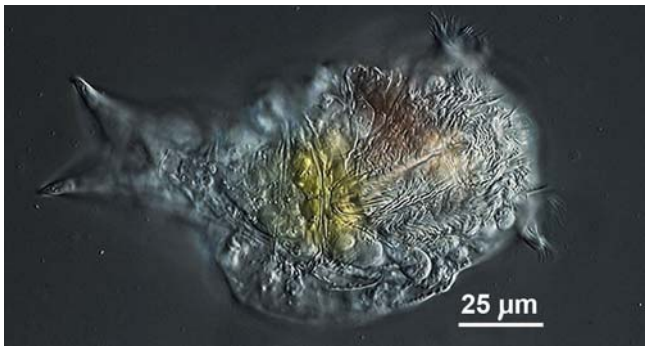

Figure 99. ***Notommata tripus*** from *Myriophyllum*. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 100. ***Notommata tripus***, a species known to inhabit bryophytes in more than one location and also occurs in bog pools. Photo by Jersabek *et al.* 2003, with permission.

On Svalbard ***Notommata glyphura*** (Figure 101) occurs on submerged mosses, but also occurs among the plankton (De Smet 1993).

Figure 101. ***Notommata glyphura***, a species of plankton and submerged mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Pleurata

Of the seven species in ***Pleurata***, three are associated with bryophytes. All of these are associated with ***Sphagnum*** (Figure 41) and include ***P. chalicodes*** (Figure 102), ***P. tithasa*** (Figure 103), and ***P. vernalis*** (Figure 104) (Jersabek *et al*. 2003). In Alaska, ***P. chalicodes*** occurs with submerged mosses in trenches of polygons (Segers *et al*. 1996).

Figure 102. ***Pleurata chalicodes*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 103. ***Pleurata tithasa*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 104. ***Pleurata vernalis*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Pleurotrocha

Although ***Pleurotrocha*** has eight species, only two of these are associated with bryophytes. ***Pleurotrocha petromyzon*** (Figure 105) occurs with the aquatic moss ***Fontinalis*** (Figure 58) (Plewka 2016). The only

Sphagnum (Figure 41) dweller seems to be ***P. robusta*** (Figure 106-Figure 107; Jersabek *et al*. 2003).

Figure 105. ***Pleurotrocha petromyzon***, a species that occurs on the aquatic moss ***Fontinalis***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 106. ***Pleurotrocha robusta*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 107. ***Pleurotrocha robusta*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Pseudoploesoma

Pseudoploesoma is a small genus with only one species, ***P. formosum*** (Figure 108-Figure 110). It occurs among ***Sphagnum*** in bog ponds (Figure 2) (Myers 1942; Jersabek *et al.* 2003).

Figure 108. ***Pseudoploesoma formosum*** from among ***Sphagnum*** in a bog pond. Photo by Jersabek *et al.* 2003, with permission.

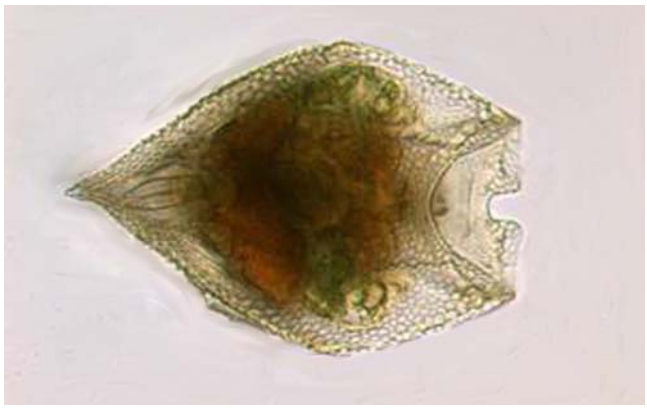

Figure 109. ***Pseudoploesoma formosum*** from among ***Sphagnum*** in a bog pond. Photo by Jersabek *et al.* 2003, with permission.

Figure 110. ***Pseudoploesoma formosum*** from among ***Sphagnum*** in a bog pond. Photo by Jersabek *et al.* 2003, with permission.

Resticula

Three members of ***Resticula*** are associated with bryophytes and other submerged plants. ***Resticula melandocus*** (Figure 111-Figure 113) occurs in ***Sphagnum***

bogs (Figure 2) (Hingley 1993), but also is associated with the alga ***Nitella*** (Jersabek *et al*. 2003; Plewka 2016). ***Resticula nyssa*** (Figure 114-Figure 115) is a littoral species that lives on plant surfaces, including bryophytes (de Manuel Barrabin 2000), including ***Sphagnum*** (Figure 41) (Hingley 1993). On Svalbard, it occurs exclusively on submerged mosses (De Smet 1993). It prefers slightly acidic water, although the measured *p*H was 8.2. Its temperature preference is around 18.8°C (de Manuel Barrabin 2000). ***Resticula plicata*** (Figure 116) lives in ***Sphagnum*** ponds (Figure 2) (Plewka 2016).

Figure 111. ***Resticula melandocus*** from the alga ***Nitella***, but this rotifer also occurs in ***Sphagnum*** bogs. Photo by Michael Plewka <www.plingfactory.de>, with permission.

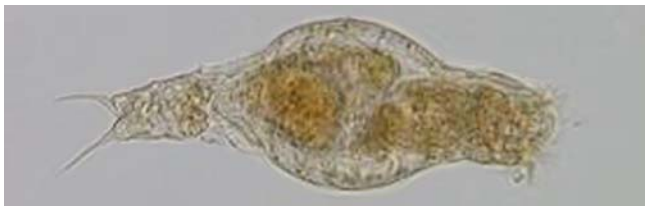

Figure 112. ***Resticula melandocus***, known from a ***Sphagnum*** bog. Photo by Jersabek *et al*. 2003, with permission.

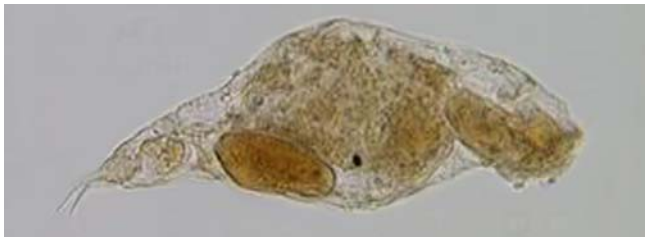

Figure 113. ***Resticula melandocus***, side view, a species known from bryophytes. Photo by Jersabek *et al*. 2003, with permission.

Figure 114. ***Resticula nyssa***, a littoral species that lives on plant surfaces, including bryophytes. Photo by Jersabek *et al*. 2003, with permission.

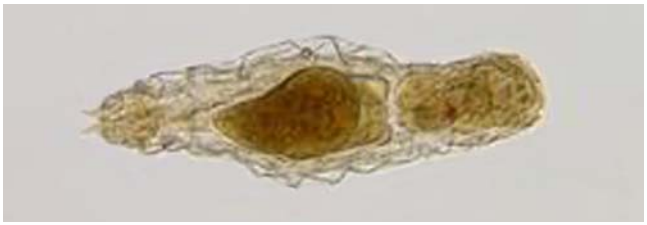

Figure 115. ***Resticula nyssa***, known from a ***Sphagnum*** bog. Photo by Jersabek *et al*. 2003, with permission.

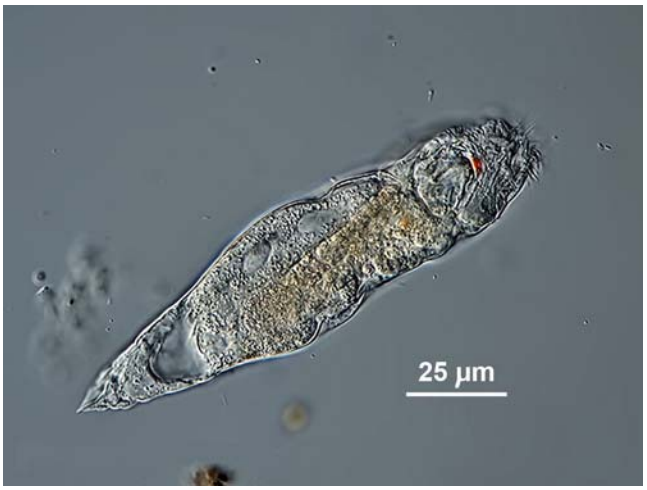

Figure 116. ***Resticula plicata***, inhabitant of ***Sphagnum*** ponds. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Taphrocampa

Taphrocampa is a genus with only four species. Of these, two are known from ***Sphagnum*** (Figure 41): ***T. annulosa*** (Figure 117-Figure 118) and ***T. clavigera*** (Figure 119) (Hingley 1993; Jersabek *et al*. 2003).

Figure 117. ***Taphrocampa annulosa***, known from a ***Sphagnum*** bog. Photo by Jersabek *et al*. 2003, with permission.

Figure 118. ***Taphrocampa annulosa***, lateral view, a species known from **bryophytes**. Photo by Jersabek *et al*. 2003, with permission.

Figure 119. ***Taphrocampa clavigera***, a species known from ***Sphagnum*** in more than one location. Photo by Jersabek *et al.* 2003, with permission.

Proalidae

This family lacks a hardened lorica and instead takes on a wormlike appearance. It lives in freshwater and occurs on plants, on the bottom, and among sand grains of the littoral zone as well as in damp terrestrial habitats (EOL 2012). Some are even **epizoic** on other invertebrates and some live parasitically in algae or on invertebrates.

Bryceella

This genus is **oviparous** (producing eggs that are laid and hatch later). All known species of the genus ***Bryceella*** live among ***Sphagnum*** (Figure 41). ***Bryceella tenella*** (Figure 120-Figure 121) seems to be known only from ***Sphagnum*** (Myers 1942; Hingley 1993; Jersabek *et al.* 2003; Bielańska-Grajner, *et al*. 2011). On the other hand, ***Bryceella perpusilla*** (Figure 122; Wilts *et al*. 2010) and ***B. stylata*** (Figure 123-Figure 124; Hingley 1993; Plewka 2016) both occur on ground-dwelling and epiphytic mosses as well as aquatic habitats, illustrating an ability to tolerate a wide moisture range. Segers *et al*. (1996) reports ***B. stylata*** from submerged mosses in trenches of Alaskan polygons; on Svalbard, it occurs exclusively on submerged mosses (De Smet 1993). ***Bryceella pusilla*** (Figure 125), previously known as ***Wierzejskiella vagneri***, is known from a ***Sphagnum*** bog (Plewka 2016).

Bryceella perpusilla (Figure 122) was described as a new species in 2010 from northwest Germany (Wilts *et al.* 2010). Its describers considered it to be one of the smallest rotifers (50-80 µm) and even one of the smallest metazoans known. Even its name, *perpusilla*, means very small. This small size, combined with its narrow body and dorsiventral compression, permits it to live among terrestrial mosses. The individuals glide among the mosses in a "nimble and jerky manner very fast on the moss stalks" and eat the detritus associated with the mosses. Even in the lab, they never leave the moss to swim. But they are not restricted to these terrestrial mosses. They also occur among ***Sphagnum*** (Figure 41) in Lake Gorbacz in Poland. They seem to prefer cold periods at about 10°C.

Figure 120. ***Bryceella tenella***, a ***Sphagnum*** associate. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 121. ***Bryceella tenella***, a ***Sphagnum*** associate. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 122. ***Bryceella perpusilla***, a species that lives among epiphytic mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 123. ***Bryceella stylata*** (stomach stained neutral red), a species that lives in ***Sphagnum*** bogs and on epiphytic mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 124. ***Bryceella stylata***, a species known from **bryophytes**. Photo by Jersabek *et al.* 2003, with permission.

Figure 125. ***Bryceella pusilla*** from a ***Sphagnum*** bog. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Proales

Proales is a somewhat larger genus. A number of its species occur among ***Sphagnum*** (Figure 41). These include ***Proales bemata*** (Figure 126; Myers 1942), ***P. cognita*** [Figure 127-Figure 128; on ***Sphagnum cuspidatum*** (Figure 129); Jersabek *et al.* 2003], ***P. decipiens*** (Figure 130; Horkan 1981; Hingley 1993; Harrington & Myers 1922), ***P. doliaris*** (Figure 131; ***Sphagnum*** bogs; Hingley 1993; Jersabek *et al.* 2003), ***P. fallaciosa*** (Figure 132-Figure 134; Hingley 1993), ***P. latrunculus*** (current name not located; Hingley 1993), ***P. micropus*** (Hingley 1993), ***P. minima*** [Figure 135-Figure 136; on ***Sphagnum subsecundum*** (Figure 53); Hingley 1993; Plewka 2016], ***P. ornata*** (Myers 1942), ***P. palimmeka*** (Figure 137; on submerged ***Sphagnum***; Jersabek *et al.* 2003), and ***P. sordida*** (Horkan 1981).

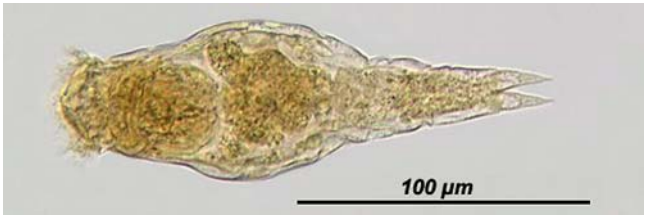

Figure 126. ***Proales bemata***, a ***Sphagnum*** dweller. Photo by Jersabek *et al.* 2003, with permission.

Figure 127. ***Proales cognita*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 128. ***Proales cognita*** from among ***Sphagnum cuspidatum***. Photo by Jersabek *et al.* 2003, with permission.

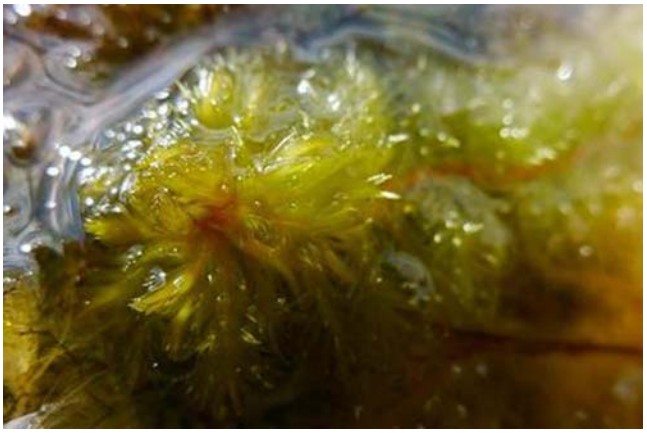

Figure 129. ***Sphagnum cuspidatum***, home of ***Cephalodella subsecunda***. Photo through Creative Commons.

Figure 130. ***Proales decipiens***, a species known to occur in bogs and to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 131. ***Proales doliaris***, a species known from ***Sphagnum*** bogs. Photo by Jersabek *et al*. 2003, with permission.

Proales fallaciosa (Figure 132-Figure 134) is a cosmopolitan, benthic-periphytic (and planktonic) species of small water bodies (de Manuel Barrabin 2000). It is known to inhabit bryophytes, including ***Sphagnum*** (Figure 41). On Svalbard it inhabits submerged mosses (De Smet 1993). It lives in alkaline to slightly acid water with a *p*H around 8.39 and temperature around 18.8°C (de Manuel Barrabin 2000) where it feeds on bacteria, detritus, algae, and microcrustaceans (Koste & Shiel 1990).

Figure 132. ***Proales fallaciosa***, a cosmopolitan species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 133. ***Proales fallaciosa***, a species known to inhabit bryophytes. Photo by Jersabek *et al*. 2003, with permission.

Figure 134. ***Proales fallaciosa***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 135. ***Proales minima*** occurs on submersed moss, including ***Sphagnum subsecundum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 136. ***Proales minima***, a species collected from bryophytes. Photo by Jersabek *et al.* 2003, with permission.

Figure 137. ***Proales palimmeka*** from among ***Sphagnum***. Photo by Jersabek *et al*. 2003, with permission.

In addition to these ***Sphagnum*** dwellers, ***Proales ardechensis*** (Figure 138) lives in a seepage area where wet mosses attach to a vertical rock face that dries up in summer (De Smet & Verolet 2009). The *p*H there is 7.35 and water temperature of 7°C. ***Proales globulifera*** (Figure 139) is part of the periphyton on ***Fontinalis*** (Figure 58) (Plewka 2016), and ***P. theodora*** (Figure 140-Figure 141) associates with bryophytes in streams and rivulets (Madaliński 1961).

Figure 138. ***Proales ardechensis***, a species that lives among wet mosses on rocks in seepage areas. Photo by Michael Verolet, with permission.

Figure 139. ***Proales globulifera***, a species periphytic on ***Fontinalis***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 140. ***Proales theodora***, a plankton species that also associates with mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 141. ***Proales theodora***, a plankton species that also occurs among mosses. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Proales laticauda (Figure 142) is the only terrestrial member of the genus that I have found. De Smet and Verolet (2009) first described it from moss on sandstone in a firewood area. Plewka (2016) reported it from mosses where it accompanied mucilaginous green algae.

Figure 142. ***Proales laticauda***, a species that occurs on moss with mucilaginous green algae. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Proalinopsis

Proalinopsis is a genus of only seven species. Among these, three are associated with ***Sphagnum*** (Figure 41) or live in bogs. These are ***Proalinopsis caudatus*** (Figure 143-Figure 144) in bog pools (Horkan 1981; Hingley 1993; Plewka 2016), ***P. phacus*** on ***Sphagnum*** (Myers 1942), and ***P. squamipes*** (Figure 145) from a ***Sphagnum*** ditch and bogs (Hingley 1993; Jersabek *et al.* 2003). ***Proalinopsis gracilis*** (Figure 146) is known from the floating thallose liverwort ***Riccia fluitans*** (Figure 147) (Jersabek *et al.* 2003).

Figure 143. ***Proalinopsis caudatus*** from a ***Sphagnum*** pond. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 144. ***Proalinopsis caudatus***, a species known to inhabit bryophytes and to occur in bog pools. Photo by Jersabek *et al.* 2003, with permission.

Figure 145. ***Proalinopsis squamipes***, known from a ***Sphagnum*** ditch. Photo by Jersabek *et al.* 2003, with permission.

Figure 146. ***Proalinopsis gracilis*** from among the floating thallose liverwort ***Riccia fluitans***. Photo by Jersabek *et al.* 2003, with permission.

Figure 147. ***Riccia fluitans***, home for ***Proalinopsis gracilis.*** Photo by Christian Fischer, through Creative Commons.

Wulfertia

On Svalbard, ***Wulfertia ornata*** occurs exclusively among submerged mosses in a pool (De Smet 1993).

Scaridiidae

This is a segregate family from **Notommatidae** (Segers 1995). At least some of the species are cosmopolitan; some are pantropical. ***Scaridium*** is the only genus and has only seven species. ***Scaridium longicaudum*** (Figure 148-Figure 150) is associated with bryophytes. It is occasionally planktonic (Plewka 2016), but it can occur in bogs (Horkan 1981) and typically occurs between vegetation (De Smet, pers. comm. 14 November 2016). ***Scaridium montanum*** occurs in ***Sphagnum*** ponds.

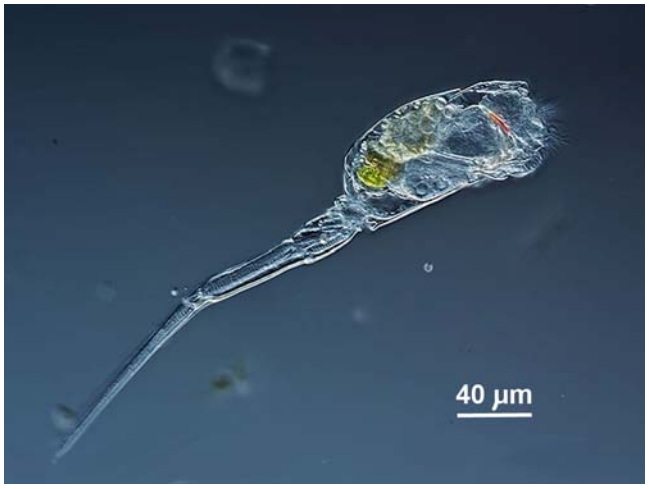

Figure 148. ***Scaridium longicaudum*** lateral view, a periphytic species that can be found in bogs. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 149. ***Scaridium longicaudum*** from Pocono Lake, Pennsylvania, USA. This species is known from bogs. Photos by Jersabek *et al.* 2003, with permission.

Figure 150. ***Scaridium longicaudum***, a bog species. Photos by Jersabek *et al.* 2003, with permission.

Synchaetidae

To my mind, this family has some of the most unusual-looking rotifers. It has only four genera, three of which include bryophyte associates.

Polyarthra

Polyarthra (Figure 153, Figure 157-Figure 158) reminds me of a Native American headdress. Many of the species have long blade-like flexible appendages – my association with feathers and headdresses. The members of the genus are planktonic, but a few species have been found among bryophytes. They feed by a grabbing and sucking motion.

Gilbert and Schroder (2004) suggested that the **diapause** (resting) eggs (Figure 151) that develop into amictic females in species like ***Polyarthra vulgaris*** (Figure 151-Figure 152), occasionally a moss dweller, may be an adaptation for survival in an environment that is unstable. These amictic females have a higher lipid content, reduced digestive tract, and produce a single large egg within hours of hatching, whereas the normal generation time is six days. The diapause eggs are produced by sexual reproduction of a female and small male (from small eggs; Figure 152), thus producing a **diploid egg** (one having two sets of chromosomes). Like many algae and other plants, this behavior of sexual reproduction occurs when the environment becomes unfavorable. The diapause egg is able to remain viable without hatching for extended periods of time.

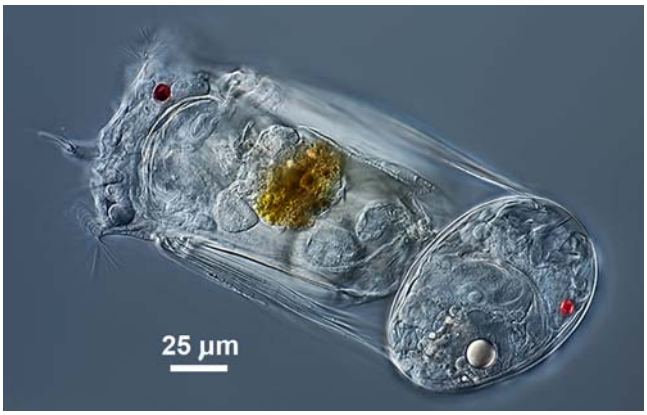

Figure 151. ***Polyarthra vulgaris*** with parthenogenetic diploid amictic egg. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 152. ***Polyarthra vulgaris*** with male eggs (smaller than female eggs). Photo by Michael Plewka (www.plingfactory.de), with permission.

Polyarthra euryptera (Figure 153) is a cosmopolitan planktonic species (de Manuel Barrabin 2000) that is known from bog pools (Horkan 1981). They occur in warm water, but are known from temperatures in the wide range of 5.9-24.9°C (de Manuel Barrabin 2000). They are seasonal, reaching a maximum population size in the summer. They generally do not occur in the hypolimnion, where they would be trapped in cold water. This species may be prey for other rotifers, including ***Asplanchna girodi*** (Figure 154) and ***Ploesoma hudsoni*** (Figure 155-Figure 156) (Guiset 1977). Their known *p*H range is 6.3-9.9.

Figure 153. ***Polyarthra euryptera***, a cosmopolitan planktonic species that is known from bog pools. Photo by Jersabek *et al*. 2003, with permission.

Figure 154. ***Asplanchna girodi*** (with resting egg), a species that preys upon ***Polyarthra euryptera***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

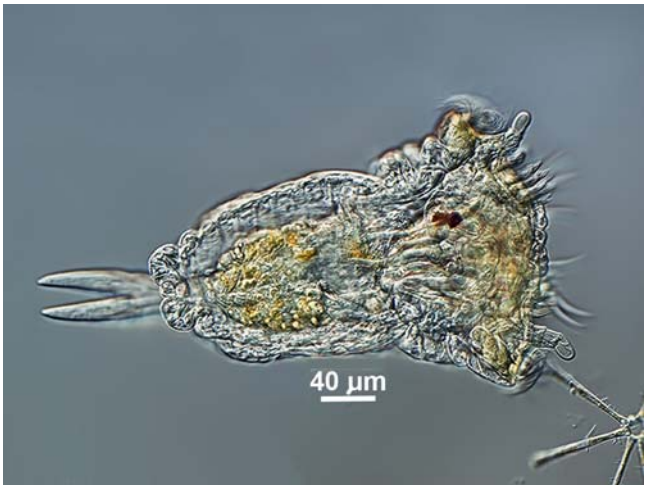

Figure 155. ***Ploesoma hudsoni*** dorsiventral view, a predator on ***Polyarthra euryptera***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 156. ***Ploesoma hudsoni*** (lateral view), a predator on ***Polyarthra euryptera***. Photo by Michael Plewka <www.plingfactory.de>, with pernission.

Polyarthra vulgaris (Figure 157-Figure 158) has likewise been found among mosses, including ***Sphagnum*** (Figure 41), in bogs (Hingley 1993), although it is a planktonic species (de Manuel Barrabin 2000). This species is cosmopolitan and present year-round. To accommodate its year-round activity, it tolerates temperatures 5.9-16-7°C. It prefers high levels of oxygen, a *p*H range of 6.6-6.9, and lives near the water surface, rarely occurring in the hypolimnion. It feeds on centric diatoms and algae in the **Cryptomonadaceae** (Pourriot 1977) and **Chrysophyceae** (Devetter 1998), as well as bacteria and one-celled **Chlorophyta** (Bogden & Gilbert 1987). Bogden and Gilbert (1987) describe the feeding as a suction that uses pharyngeal expansion. The fecundity is positively related to the amount of chlorophyll *a* present (Devetter & Sed'a 2003). They are especially important in the food web, along with other rotifers, when the hydrological conditions are unstable (Keckeis *et al*. 2003).

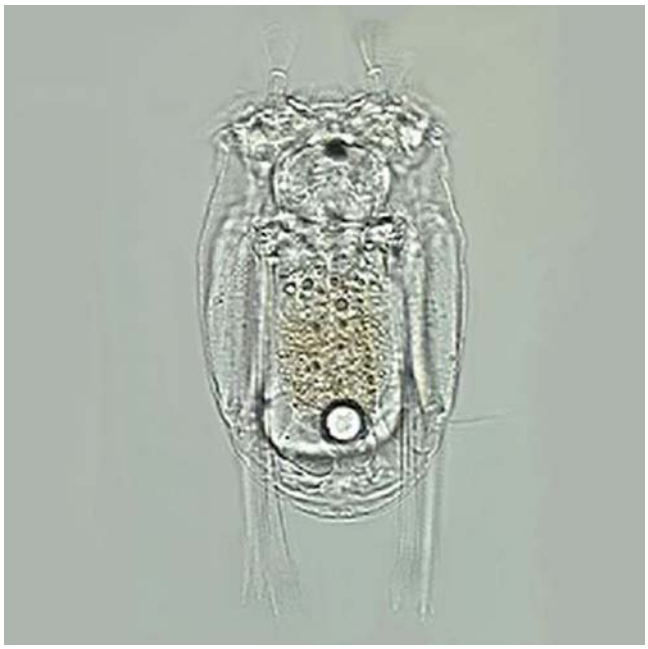

Figure 157. ***Polyarthra vulgaris*** has been found among mosses, although it is a planktonic species. Photo from Malcolm Storey, through Creative Commons.

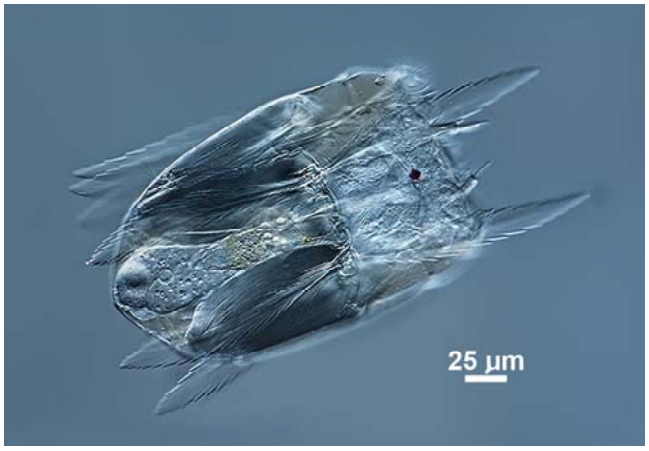

Figure 158. ***Polyarthra vulgaris***, a planktonic species that lives among ***Sphagnum*** in bogs. Photo by Michael Plewka

Synchaeta

The genus ***Synchaeta*** (Figure 159) is typically planktonic in both freshwater and marine environments, it also has members that live on bryophytes in freshwater (Hingley 1993). It also is one of the few rotifers to live in the marine environment (Brownell 1988; Wikipedia 2012), but not on bryophytes there (bryophytes do not occur in the marine environment). It prefers cold water and is absent in the warm water habitats of southeast Asia (Segers 2001).

Figure 159. ***Synchaeta***, a cold-water genus that occurs on bryophytes (Hingley 1993). Photo by Wim van Egmond, with permission.

Synchaeta pectinata (Figure 160-Figure 161) is a cosmopolitan planktonic species (de Manuel Barrabin 2000) that has been collected from bryophytes and can live in bog pools (Horkan 1981; Hingley 1993). Although it survives at temperatures of 5.9-25.5°C, it has its maximum populations at low temperatures (de Manuel Barrabin 2000). It lives in both small and large lakes at *p*H 6.3-9.3. The food is primarily algae of the **Cryptomonadaceae**, **Chrysophyceae**, and centric diatoms (Pourriot 1970). The species is often infected by the fungus *Plistophora* (*Bertramia*) *asperospora*. ***Synchaeta tremula*** (Figure 162) occurs in bogs (Horkan 1981).

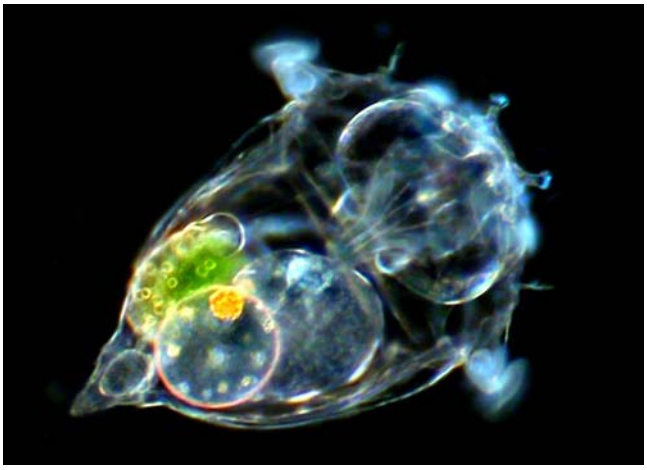

Figure 160. ***Synchaeta pectinata*** from plankton. Photo by Michael Plewka <www.plingfactory.de>), with permission.

Figure 161. ***Synchaeta pectinata***, typically a cosmopolitan planktonic species, also lives among bryophytes and can live in bog pools. Photo by Jersabek *et al.* 2003, with permission.

Figure 162. ***Synchaeta tremula*** from a lake in New Jersey, USA. This species also occurs in bogs. Photo by Jersabek *et al.* 2003, with permission.

Tetrasiphonidae

As nearly as I can determine, there is one genus and possibly two species in this family, although Segers (2007) only lists ***Tetrasiphon hydrocora*** (Figure 163-Figure 164); one species remains undescribed. This species is known from ***Sphagnum*** (Figure 41) and submersed mosses (Nogrady 1980; Hingley 1993; Plewka 2016).

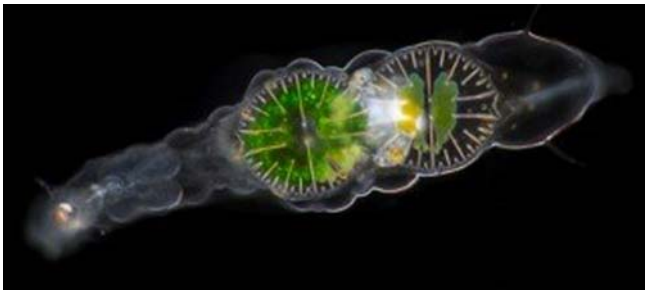

Figure 163. ***Tetrasiphon hydrocora***, a species known from ***Sphagnum***, with the desmid ***Micrasterias*** in its gut. Photo by Wim von Egmond, with permission.

Figure 164. ***Tetrasiphon hydrocora***, a species known from ***Sphagnum***. Note desmids in the gut. Photo by Jersabek *et al.* 2003, with permission.

Trichocercidae

The members of this family usually have a twisted body and strongly asymmetrical trophi. Some members are parasitic. Some live among bryophytes, including ***Sphagnum*** (Figure 41).

Elosa

Elosa has a symmetrical body, but the trophi are asymmetrical. ***Elosa worrallii*** (Figure 165) shares the genus with one other species that is sometimes considered to be conspecific with ***E. worrallii*** (Segers 2007). ***Elosa worrallii*** lives among bryophytes, including ***Sphagnum*** (Myers 1942; Hingley 1993).

Figure 165. ***Elosa worrallii*** with notch in lorica, a species known from bryophytes, including ***Sphagnum*** (Myers 1942). Photo by Michael Plewka <www.plingfactory.de>, with permission.

Trichocerca

By contrast to ***Elosa***, ***Trichocerca*** is a larger genus. ***Trichocerca bicristata*** (Figure 166-Figure 167) is planktonic, but lives in bog pools (Figure 2; Horkan 1981; Hingley 1993). ***Trichocerca brachyura*** (Figure 168) occurs in bogs in the Pocono Mountains, Pennsylvania, USA (Horkan 1981; Jersabek *et al.* 2003). ***Trichocerca cavia*** (Figure 169) is likewise a species known from ***Sphagnum*** bogs, living on submerged mosses (Hingley 1993; Plewka 2016). On Svalbard, ***T. cavia*** occurs among submerged mosses, but also occurs in the plankton (De Smet 1993). Among others known from ***Sphagnum*** bogs, Hingley (1993) included ***T. collaris*** (Figure 170), ***T. elongata*** (Figure 171), ***T. junctipes*** (***T. sejunctipes***?), ***T. longiseta*** (Figure 172-Figure 173), ***T. porcellus*** (Figure 174-Figure 175; see also Bielańska-Grajner *et al*. 2011) [also from ***Fontinalis*** (Jersabek *et al*. 2003)], ***T. rattus*** (Figure 178-Figure 179), (also Horkan 1981; Jersabek *et al*. 2003), and ***T. rosea*** (Figure 180-Figure 181; also Jersabek *et al*. 2003).

Figure 166. ***Trichocerca bicristata***, a planktonic species that lives in ***Sphagnum*** pools. Photo by Michael Plewka <www.plingfactory.de>, with permission.

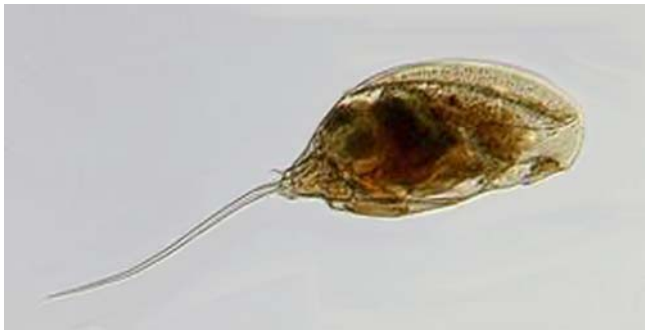

Figure 167. ***Trichocerca bicristata***, a rotifer known from bog pools. Photo by Jersabek *et al.* 2003, with permission.

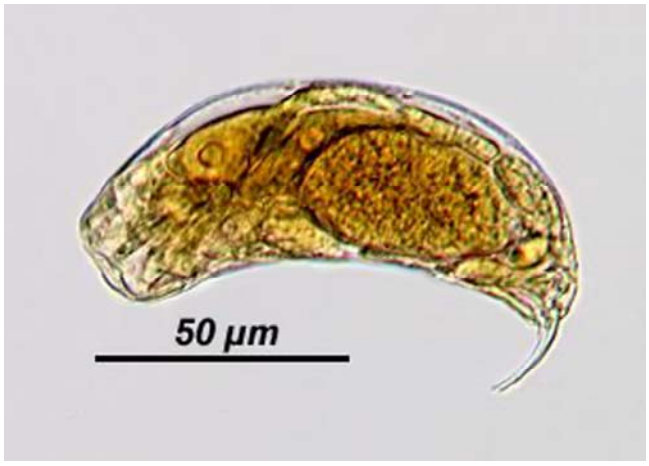

Figure 168. ***Trichocerca brachyura*** from the Pocono Mountains, Pennsylvania, USA. This species is known from bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 169. ***Trichocerca cavia***, a species that lives on submerged moss and in ***Sphagnum*** bogs. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 170. ***Trichocerca collaris***, known from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

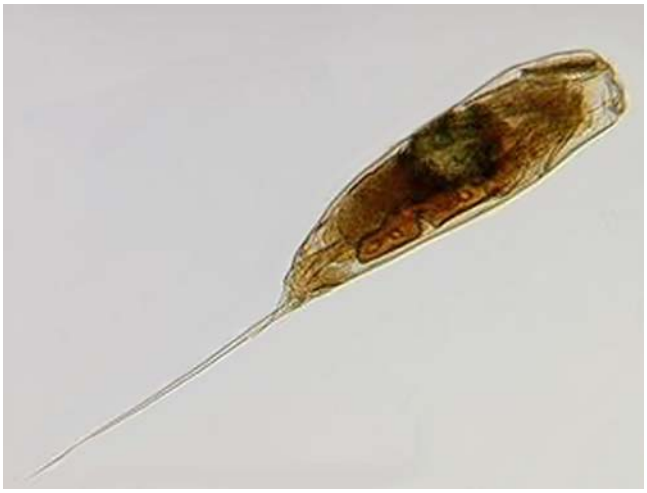

Figure 171. ***Trichocerca elongata***, a species known from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 172. ***Trichocerca longiseta***, a species known from bogs. Photo by Yuuji Tsukii, with permission.

Figure 173. ***Trichocerca longiseta***, known from a bog. Photo by Jersabek *et al.* 2003, with permission.

Trichocerca major (Figure 175) and ***T. porcellus*** (Figure 174) are cosmopolitan species in small water bodies with limited nutrients (de Manuel Barrabin 2000). ***Trichocerca major*** is known from both a bog and ***Fontinalis*** (Jersabek *et al.* 2003). Both species typically occur between vegetation as periphyton (De Smet, pers. comm. 14 November 2016). ***Trichocerca porcellus*** is active in winter at temperatures around 9.5°C and occurs at a *p*H around 7.1. It lays eggs inside algal mats such as ***Aglaucoseria***, ***Fragilaria*** (Figure 176), and ***Dinobryon*** (Figure 177). It is known from bryophytes in multiple locations, including collections of the aquatic moss ***Fontinalis*** (Figure 58).

Figure 174. ***Trichocerca porcellus***, a cosmopolitan periphytic species known from the aquatic moss ***Fontinalis***. Photo by Jersabek *et al.* 2003, with permission.

Figure 175. ***Trichocerca major***, a species known from both a bog and ***Fontinalis***. Photo by Jersabek *et al.* 2003, with permission.

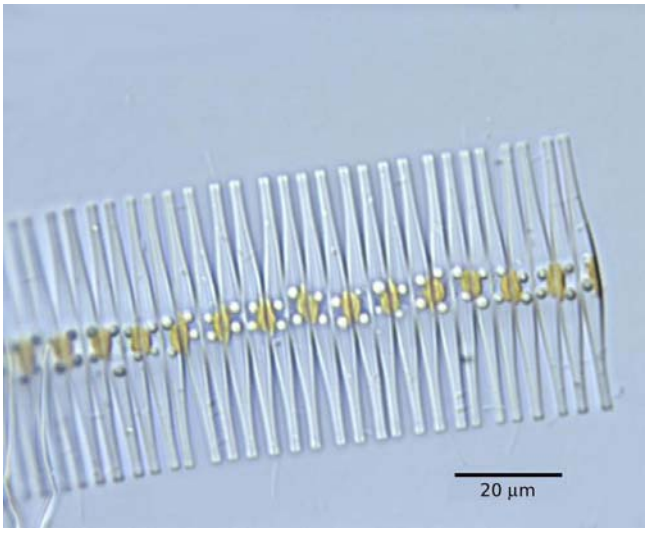

Figure 176. ***Fragilaria***, egg-laying site of ***Trichocerca porcellus***. Photo by Jason Oyadomari, with permission.

Figure 177. ***Dinobryon divergens***, in a genus that is an egg-laying site for ***Trichocerca porcellus*** and food for ***Trichocerca similis***. Photo by Frank Fox, through Creative Commons.

Figure 178. ***Trichocerca rattus*** lateral view. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 179. ***Trichocerca rattus*** f. ***carinata***, a form of a species known from ***Sphagnum*** bogs. Photo by Jersabek *et al.* 2003, with permission.

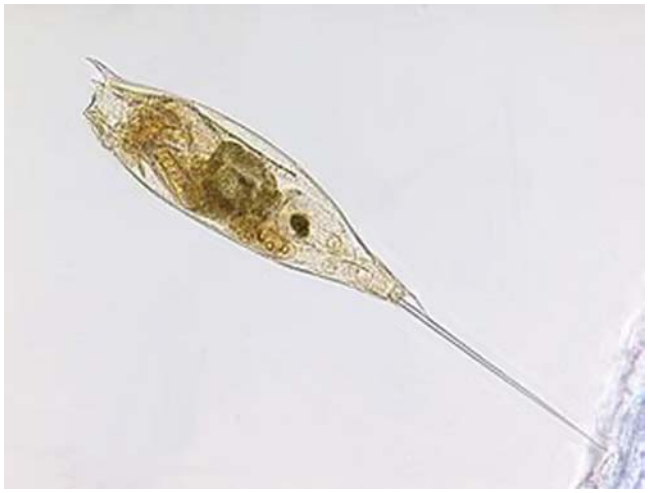

Figure 180. ***Trichocerca rosea***. This species is known from more than one bog. Photo by Jersabek *et al.* 2003, with permission.

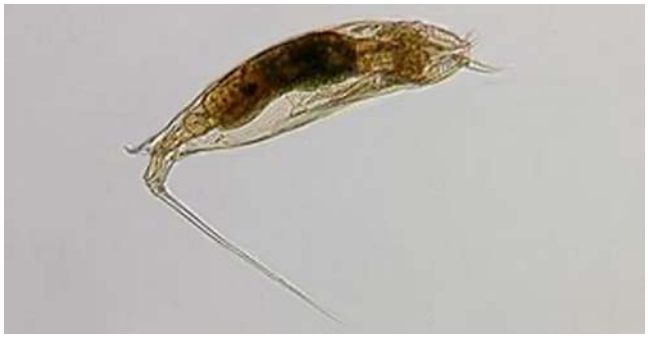

Figure 181. ***Trichocerca rosea***, a species that been found in more than one location on ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Trichocerca similis (Figure 182-Figure 183) is a planktonic rotifer, but it also is known from bryophytes and bog pools in Pennsylvania, USA (Myers 1942; Horkan 1981). It is likely to be cosmopolitan, preferring warmer waters (de Manuel Barrabin 2000). It attaches its asexual eggs to other members of the plankton (Pourriot 1970). It prefers a slightly basic *p*H of 7-9.63 and temperatures of 9.5-26.2°C (de Manuel Barrabin 2000). Food is predominantly Cryptomonadaceae and Chrysophyceae, especially *Mallomonas* (Figure 184) and *Dinobryon* (Figure 177). It is a common food item of predator rotifers such as ***Asplanchna*** (Figure 154) and *Ploesoma* (Figure 155-Figure 156) (Guiset 1977).

Figure 182. ***Trichocerca similis***, a planktonic species that also occurs with bryophytes and in bog pools. Photo by Jersabek *et al.* 2003, with permission, with permission.

Figure 183. ***Trichocerca similis***, a plankton species that lives among bryophytes and in bog pools. Photo by Michael Plewka <www.plingfactory.de>, with permission.

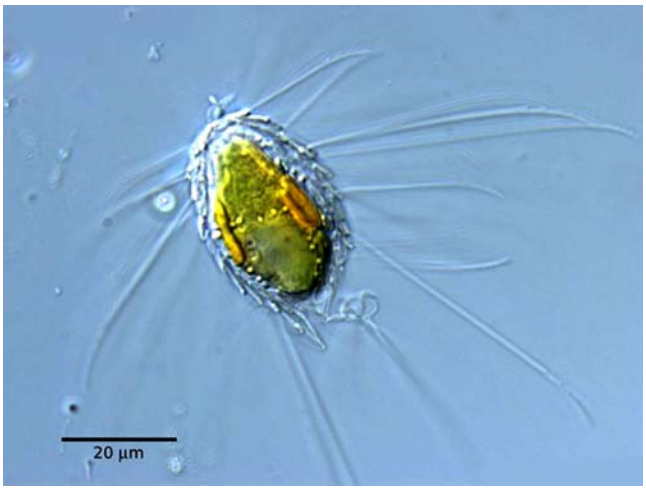

Figure 184. ***Mallomonas***, food for ***Trichocerca similis***. Photo by Jason Oyadomari, with permission.

Jersabek *et al.* (2003) added several ***Sphagnum*** (Figure 41) associates. These included ***Trichocerca edmondsoni*** (Figure 185), ***T. ornata*** (Figure 186) as a bog species and ***T. lata*** (Figure 187), ***T. parvula*** (Figure 188; these two species are easily confused), ***T. platessa*** (Figure 189), ***T. rotundata*** (Figure 190), and ***T. scipio*** (Figure 191) from among ***Sphagnum***.

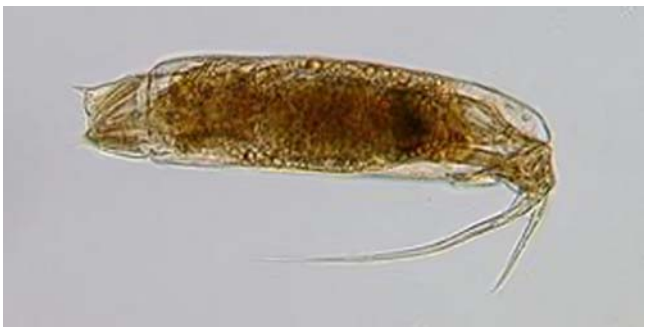

Figure 185. ***Trichocerca edmondsoni*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 186. ***Trichocerca ornata*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 187. ***Trichocerca lata*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 188. ***Trichocerca parvula*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 189. ***Trichocerca platessa*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

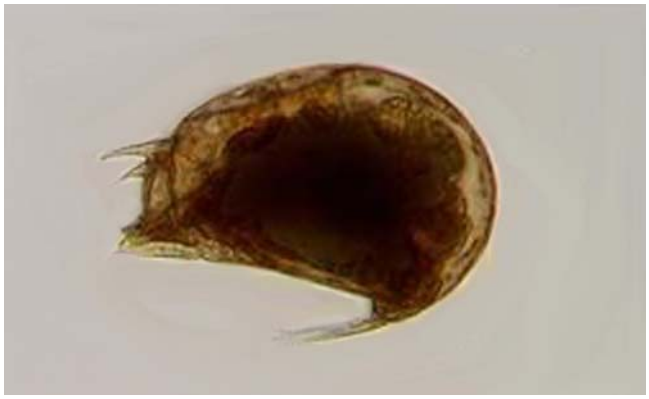

Figure 190. ***Trichocerca rotundata*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

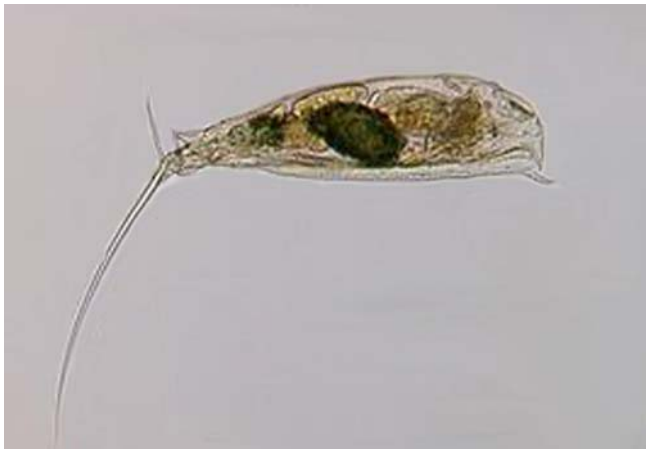

Figure 191. ***Trichocerca scipio*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Both ***Trichocerca tenuior*** (Figure 192) and ***T. tigris*** (Figure 193-Figure 195) occur in bogs (Horkan 1981; Hingley 1993), but they also both live on the thallose liverwort ***Riccia fluitans*** (Figure 147) in ponds (Jersabek *et al*. 2003). ***Trichocerca harveyensis*** (Figure 196) lives on ***Fontinalis disticha*** and seems to be the only bryophyte dweller in ***Trichocerca*** not known from ***Sphagnum*** (Figure 41) (Myers 1942; Jersabek *et al.* 2003).

Figure 192. ***Trichocerca tenuior*** from among the thallose liverwort ***Riccia fluitans***. This rotifer also occurs on bog mosses. Photo by Jersabek *et al.* 2003, with permission.

Figure 193. ***Trichocerca tigris***, a species that lives among ***Sphagnum*** and the thallose liverwort ***Riccia fluitans*** in ponds. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 194. ***Trichocerca tigris*** from among ***Sphagnum*** in a bog and ***Riccia fluitans*** in pond. It also occurs in bog pools. Photo by Jersabek *et al.* 2003, with permission.

Figure 195. ***Trichocerca tigris***, known from ***Sphagnum*** in a bog and from the thallose liverwort ***Riccia fluitans*** in a pond. Photo by Jersabek *et al.* 2003, with permission.

Figure 196. ***Trichocerca harveyensis*** from among ***Fontinalis disticha***. Photo by Jersabek *et al.* 2003, with permission.

On Svalbard, ***T. rattus*** (Figure 178-Figure 179) occurs on submerged mosses, but also in the plankton (De Smet 1993). Horkan (1981) included ***T. similis*** (Figure 183-Figure 182) as a species of bog pools. Bielańska-Grajner *et al*. (2011) added ***T. musculus***. On Svalbard, ***T. intermedia*** (rare; Figure 197), ***T. longistyla***, ***T. obtusidens*** (Figure 198), ***T. uncinata*** (Figure 199), and ***T. weberi*** (Figure 200) occur on submerged mosses, but they also occur in the plankton (De Smet 1988, 1993).

Figure 197. ***Trichocerca intermedia***, a species of submerged mosses on Svalbard. Photo by Jersabek et al. 2003, through Creative Commons.

Figure 198. ***Trichocerca obtusidens*** Jersabek *et al*. 2003, through Creative Commons.

Figure 199. ***Trichocerca uncinata***, a species of submerged mosses and plankton on Svalbard. Photo by Jersabek *et al.* 2003, through Creative Commons.

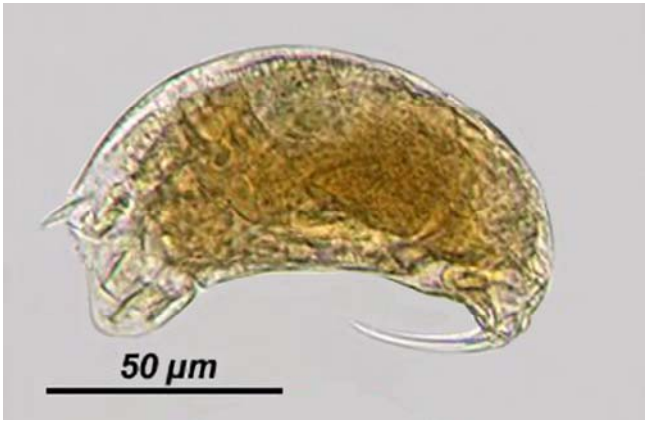

Figure 200. ***Trichocerca weberi***, a species of submerged mosses and plankton on Svalbard. Photo by Jersabek et al. 2003, through Creative Commons.

This family is one that represents the sparse studies on rotifers living on mosses in waterfalls. It is represented by ***Trichocerca pusillus*** (Figure 201) from a waterfall in Thailand (Savatenalinton & Segers 2008), but this species is more typically a plankton species (De Smet, pers. comm. 14 November 2016).

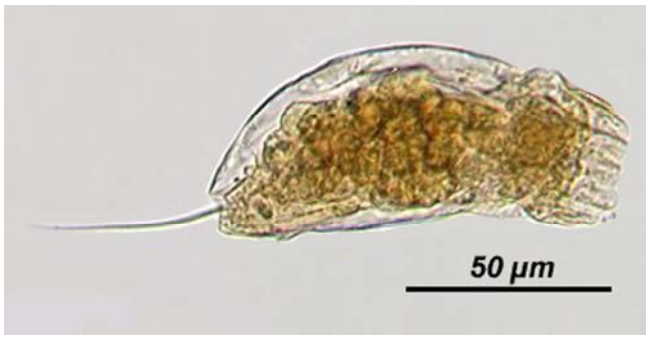

Figure 201. ***Trichocerca pusilla***, a planktonic species that can occasionally occur among wet mosses in waterfalls. Photo by Jersabek *et al.* 2003, with permission.

Trichotriidae

This family is loricate and its surface is marked with facets that have spicules or spines and are mostly granulate (Koste & Shiel 1989). The lorica extends beyond the body to the head, foot, and toes. It typically occurs both on and between aquatic plants, only occurring in the plankton when it is migrating to a new location. There are only three genera, and two of them (***Macrochaetus***, ***Trichotria***) have been collected from **bryophytes**.

Macrochaetus

Macrochaetus collinsii (Figure 203-Figure 202) inhabits bryophytes in bogs (Hingley 1993). ***Macrochaetus multispinosus*** (Figure 204) lives among ***Sphagnum*** (Figure 41; Jersabek *et al*. 2003).

Figure 202. ***Macrochaetus collinsii***, a species known to inhabit bryophytes. Photo by Jersabek *et al.* 2003, with permission.

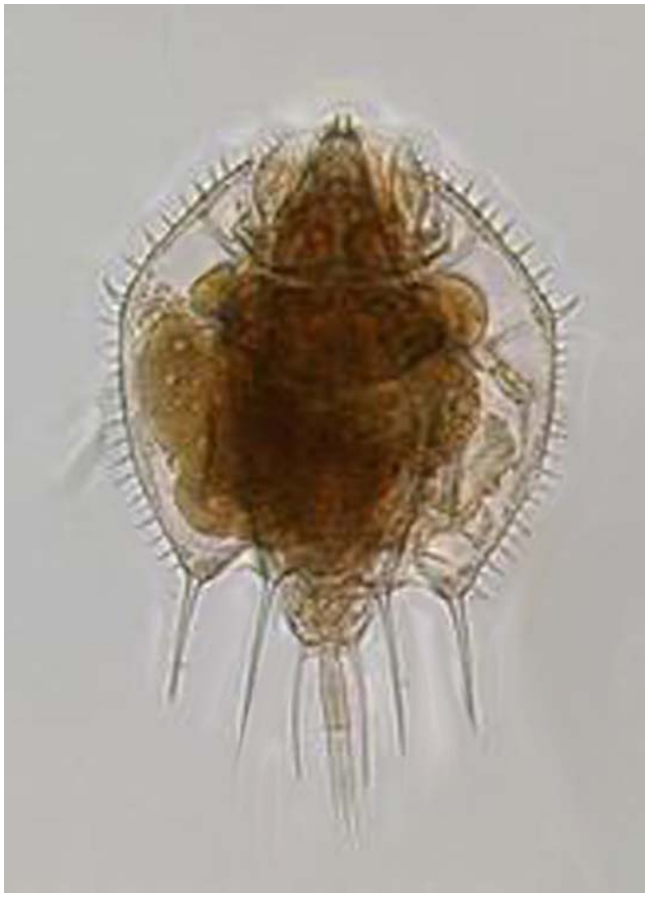

Figure 203. ***Macrochaetus collinsii***, a species known to inhabit bryophytes in bogs. Photo by Jersabek *et al.* 2003, with permission.

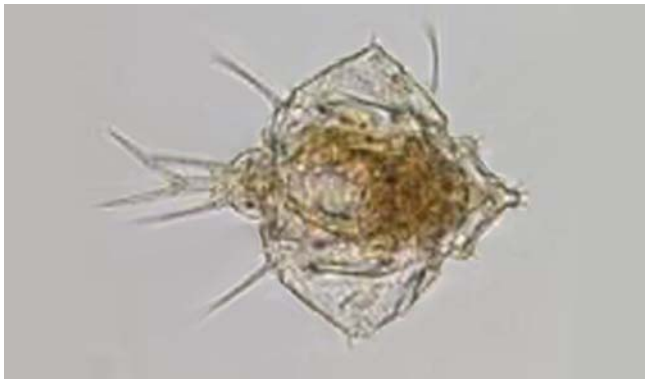

Figure 204. ***Macrochaetus multispinosus*** from among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Trichotria

Trichotria cornuta (Figure 205), ***T. pocillum*** (Figure 206-Figure 207), ***T. tetractis*** (Figure 209-Figure 212), ***Trichotria tetractis caudata*** (Figure 210), ***T. tetractis similis*** (Figure 211), and ***T. truncata*** (Figure 213-Figure 215) all live among ***Sphagnum*** (Figure 41) in bogs (Horkan 1981; Hingley 1993; Jersabek *et al.* 2003; Bielańska-Grajner *et al*. 2011; Plewka 2016). ***Trichotria pocillum*** is a cosmopolitan species that lives on plant substrata (de Manuel Barrabin 2000), including bryophytes, and can occur in bogs (Horkan 1981). It eats the organic detritus and algae, particularly diatoms, that accumulate among the plants (de Manuel Barrabin 2000). It is widely tolerant of mineralization but prefers a narrow *p*H range of 7.5-8.1. Its known temperatures are in the narrow range of 7.7-9.1, making it active only in winter, at least in Spanish reservoirs. ***Trichotria tetractis*** is a cosmopolitan species and has ecological relationships with ***T. pocillum*** (de Manuel Barrabin 2000). ***Trichotria tetractis*** is known from a *p*H around 8.1 and temperature around 18.8°C.

Figure 205. ***Trichotria cornuta*** from among submerged ***Sphagnum*** in a bog. Photo by Jersabek *et al.* 2003, with permission.

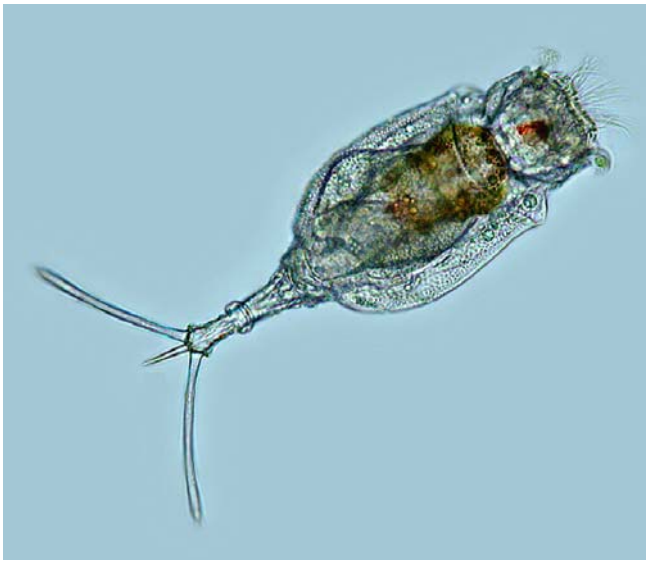

Figure 206. ***Trichotria pocillum***, a plankton and detritus dweller. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 207. ***Trichotria pocillum***, a species that lives on plant substrata (de Manuel Barrabin 2000), including bryophytes, and can occur in bogs. Photo by Jersabek *et al.* 2003, with permission.

Figure 208. ***Trichotria similis*** from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 209. ***Trichotria tetractis*** from ***Sphagnum***. Photo by Michael Plewka <www.plingfactory.de>, with permission.

Figure 210. ***Trichotria tetractis caudata***, a cosmopolitan species from bogs among ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 211. ***Trichotria tetractis similis*** (stained) from a ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

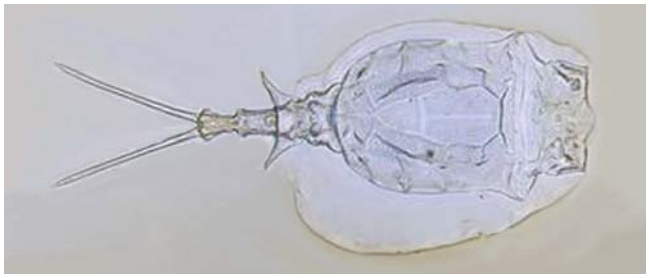

Figure 212. ***Trichotria tetractis***, a species known from ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 213. ***Trichotria truncata***, a species known from more than one ***Sphagnum*** bog. Photo by Jersabek *et al.* 2003, with permission.

Figure 214. Side view of ***Trichotria truncata***, a species known to associate with ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Figure 215. ***Trichotria truncata***, a species known from more than one location where it is associated with bryophytes, including ***Sphagnum***. Photo by Jersabek *et al.* 2003, with permission.

Summary

The monogonont order **Ploimida** is continued here from the previous sub-chapter. The **Notommatidae** is a large family with a number of species collected from bryophytes. The **Proalidae** has no hardened lorica; it occurs on freshwater plants. The **Scaridiidae** is a small family with two species from bryophytes reported here. The **Synchaetidae** has mostly planktonic members, but some have been found among bryophytes. The **Tetrasiphonidae** may have only two species, and they are known from bryophytes. The **Trichocercidae** have a twisted body; two genera have species on bryophytes. The **Trichotriidae** are loricate with spicules or spines; two genera occur on bryophytes.

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